

## Marshall Begins Testing Hybrid Rocket Motor Technology

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The Marshall Center is preparing to test a new rocket motor that will combine the safety features of a liquid-propulsion system with the cost savings of a solid-propulsion system.

The hybrid system will combine a liquid oxidizer with solid fuel in a full-scale, 250,000-lb thrust hybrid rocket motor. It will be designed, fabricated, and tested under a multipartner effort called the hybrid propulsion demonstration program. Developmental testing of the hybrid motor will be performed at MSFC's Test Stand 500 beginning in December 1996.

"The goal of the new hybrid motor program is to develop a flight-like 250,000-lb thrust hybrid motor to demonstrate critical hybrid propulsion technologies and enable manufacturing of large hybrid boosters for current and future space launch vehicles," said Roger Harwell of Marshall Center's Propulsion Technology Office. Preliminary concepts show promise for application on both the X-33 advanced technology demonstrator and the Atlas launch vehicle.

The hybrid motors may be used independently, such as for sounding rockets, or for thrust augmentation on an expendable or reusable launch vehicle.

"Safety, the most critical factor for any propulsion system, is the hybrid rocket motor's most notable feature," explained Harwell. "Hybrid motors employ an inert solid fuel and a liquid oxidizer which is physically separated until ignition. More importantly, the motor throttle can be controlled to enable on-pad check out, thrust tailoring and abort options."

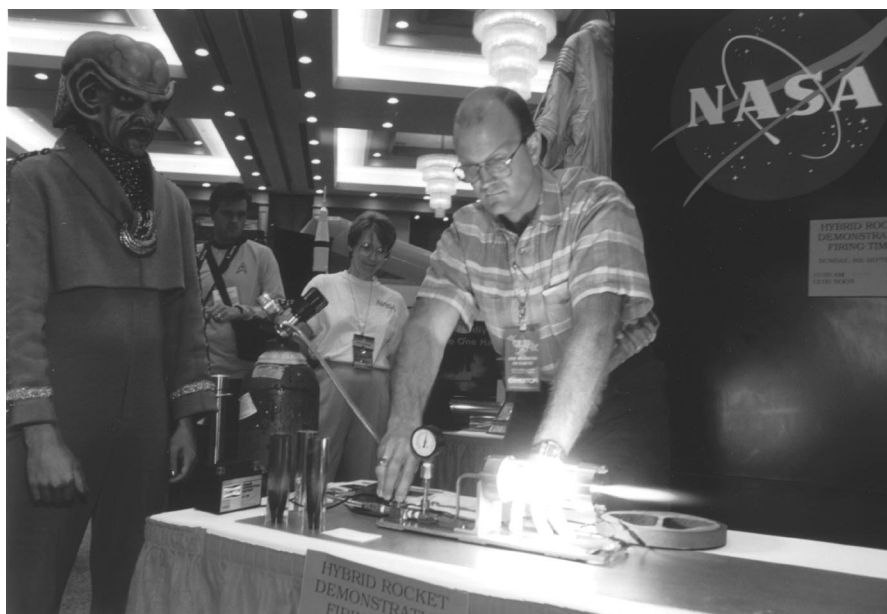
Marshall Center's role will include providing test facilities, test operations support and test analysis. "Modifications to Test Stand 500 are being made to accommodate motor development," explained Jerry Cook of MSFC's Propulsion Laboratory. "Expansions in the feed, ignition, pressurization and purge systems are expected at the test stand over the next year."

"The hybrid motor program is an excellent example of the partnership between Government and industry working to enhance and mature technologies for future applications," said Harwell. The program combines the efforts and funding of NASA, the Advanced Research Project Agency (ARPA) in Washington, D.C., Phillips Laboratory at Edwards AFB, CA, and members of an industry consortium. The consortium consists of Lockheed Martin, Thiokol, United Technologies, Rocketdyne, Allied Signal, and Environmental Aerosciences.

Marshall Center and industry have teamed in the past to develop subscale, hybrid rocket motors. An industry consortium, consisting of Thiokol, the Chemical Systems Division of United Technologies, the Rocketdyne Division of Rockwell International, Lockheed-Martin, and the American Rocket Company, joined with Marshall Center in 1989 to develop and test 11-in- and 24-in-diameter hybrid rocket motors for space vehicle applications. "Tests on the subscale motors were performed at Marshall," said Cook. "The tests have provided valuable data for the new hybrid rocket motor program."

**Sponsor:** Office of Commercial Development and Technology Transfer

**Biographical Sketch:** Bob Lessels is the technical writer/editor (physical sciences) for the Technology Transfer Office at the Marshall Center. A graduate of the University of Nebraska, he has been a professional journalist for the past 30 years. He joined NASA in 1986. ■



**FIGURE 204.—A subscale hybrid rocket engine is demonstrated for one of the more "unusual" visitors to the 1996 Star Trek 30th Anniversary celebration in Huntsville, AL. The visitor agreed the new technology was out of this world—and it should know!**